# ENVIRONMENTAL STANDARDS FOR THE CONSTRUCTION OF FOREST ROADS AND FIRE PONDS IN NOVA SCOTIA

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Nova Scotia

Canada

These standards have been prepared by the NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT and the CANADA DEPARTMENT of FISHERIES and OCEANS in consultation with the NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS, CANADIAN FORESTRY SERVICE and ENVIRONMENTAL PROTECTION SERVICE, ENVIRONMENT CANADA.

## FOR FURTHER INFORMATION

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# ENVIRONMENTAL STANDARDS FOR CONSTRUCTION OF FOREST ROADS AND FIRE PONDS IN NOVA SCOTIA

The purpose of these standards is to inform woodlot owners on how to construct wood roads, bridges, culverts and fire ponds that meet the environmental requirements of both the provincial Department of the Environment and the federal Department of Fisheries and Oceans.

By following these standards the woodlot owner will minimize damage to the water and fish resources of the province and delays in his construction. Those woodlot owners undertaking construction under the Canada Nova Scotia Forest Resource Development Agreement should note that funding will be dependent on successful implementation of these standards and their intent. These standards have been prepared in consultation with the N.S. Department of Lands and Forests and the Canadian Forestry Service and Environmental Protection Service, Environment Canada.

## PLANNING AND ROAD LAYOUT

Planning of a woods road is necessary to minimize environmental damage to watercourses and fish bearing streams. Good planning also reduces construction and maintenance costs.

The following items should be considered when planning a woods road:

1. Roads along high ground have good drainage and often easier grades. If the road were to follow high ground, this would limit the number of crossings over rivers and streams, making road construction and maintenance cheaper.

2. Side hill areas often provide better construction material while still reducing the number of stream crossings. Care must be taken to provide adequate cross drainage and balanced cross sections (cut and fill). In general roads should not be located along slopes which are greater than 30% (30 feet rise in 100 feet).

3. Traditionally, roads have been located along river valleys. Road building materials are often readily available in this area but stream crossings and drainage problems can increase cost and reduce the road bed life.

4. Avoid such features as rock outcrops, ledges and swampy areas where drainage is generally near the surface and may pose the threat of road bed slumping.

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*Please note that the accompanying Environmental Approval Form for Construction of Forest Roads and Fire Ponds is to be completed and forwarded to the Nova Scotia Department of the Environment. When authorized and returned construction can proceed. Non-compliance with the Standards which results in damage to the watercourse, destruction of fish and fish habitat might result in prosecution under the Canada Fisheries Act and/or the Nova Scotia Water and Environmental Protection Acts.

5. Avoid fragile sites having thin sandy or silty soils where needless environmental damage and high maintenance cost might be incurred.

6. Avoid sensitive habitat important to fish, wildlife, and waterfowl (contact Lands and Forests office for advice).

7. The road layout should be planned so as to maximize the distance between the road and the most significant streams, and to minimize the number of stream crossings. It is best not to construct roads within one quarter of a mile of a stream or a lake.

8. A belt of undisturbed vegetation must be maintained between the road and a stream or lake to allow silt carried by runoff from the road to be collected in the undisturbed area. A standard minimum for the width of vegetation is as follows:

| Slope of Land | Width of Vegetation Buffer |
|---|---|
| 0 - 30% | 30 m (100 feet) |
| Over 30% | 40 m (130 feet) |

9. Construction of stream crossings can only be carried out between May 15th and September 15th. This reduces damage to migrating fish and their spawning areas. For stream crossings to be constructed outside these dates, special permission must be obtained from the Nova Scotia Department of the Environment.

10. Watercourse crossings should be kept to the minimum number possible but when necessary they should be made at right angles to the stream, and on stable approaches.

11. Pipe culverts should not be larger than 1200 mm (48 inches) in diameter. For larger streams it would likely be best to construct a wooden box culvert or a small bridge.

12. Culverts are not to be placed at or near the outlet of a lake. Culverts cause water to back up and can cause flooding around the edge of a lake.

13. Pipe culverts and box culverts may be used for stream crossings where the maximum stream gradient (slope) is less than 1%. For crossings where the stream gradient is greater than 1%, use an open bottom box culvert or a bridge. Culverts with slopes greater than 1% are a barrier to fish, while bridges and open bottom box culverts have less effect on fish movement.

14. Locate stream crossings in areas of the most stable soil type and where road grades approaching the crossing will not be too great.

15. Locate bridge crossings at a narrow point on the stream, where the abutments can be constructed in the dry out of the water.

16. Natural land drainage must not be blocked by the construction of the road. Culverts will be required at all points where drainage crosses the road during a storm.

17. Roadside ditches are important to dry out the roadbed in order to keep it stable. To prevent erosion of the ditches and road way, water should not be permitted to run along the road ditch for long distances. It should be directed away from the road by cross culverts or take off ditches. Generally cross culverts with take-off ditches will be needed every 300 meters (1000 feet) along the road but actual spacing is dependent on the road grade and the area draining toward the road (see Road Drainage Section for more details).

18. The size of a cross culvert carrying only storm runoff must be determined from the land slope and area which it drains. The minimum size recommended is 450 mm (18 inches) in diameter, or 400 mm (16 inch) square box culvert. In some cases a 380 mm (15 inch) diameter culvert, or a 350 mm (14 inch) square box culvert may be used if there is no water running off nearby lands.

19. Road ditches are not to run directly into a watercourse. Take-off ditches are to be constructed about 30 m (100 feet) back from the stream, to permit the ditch drainage to run through natural vegetation before reaching the stream. No ditches are to be constructed along the road within 30 m (100 feet) of a stream (see Figure No. 1). No grubbing is permitted within 30 m (100 feet) of stream except directly under the roadbed and even then disturbance should not occur until actual start of the crossing construction.

20. Culverts of the appropriate sizes and bridge construction materials should be on hand before road construction begins.

ROAD CONSTRUCTION

a) Before Starting Construction

1. Check road standards, (Forest Access Roads Manual) available at your local Department of Lands and Forests office, and discuss them with your contractor.

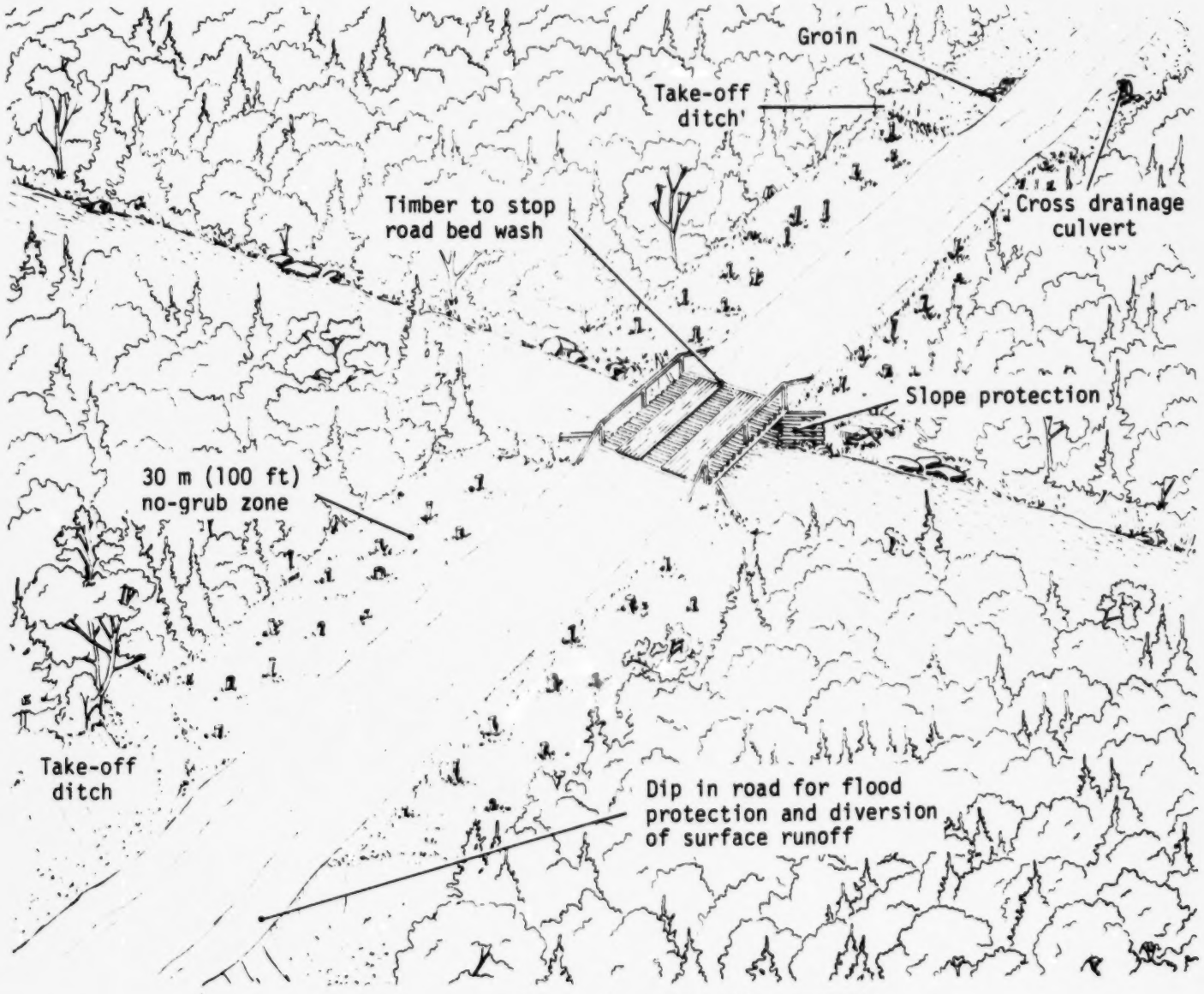
2. Mark the center line using axe blazes, spray paint or flagging tape.

3. It is best to inspect the final road location during the spring when seeps and springs are most noticeable. Change the road plan, if required.

b) Right-of-Way Clearing

1. Log all right-of-ways, landing areas, pushoff sites and borrow pit locations and remove all merchantable wood to a predetermined landing area. Do not bulldoze any merchantable standing trees since they cannot easily be placed in pushoffs and tend to intercept natural drainage patterns leading to erosion.

2. Fell trees away from water bodies; pile slash and debris such that it cannot enter water bodies during periods when the water is at an extreme high level. Felled trees are not to be transported


Groin
Take-off ditch'
Timber to stop road bed wash
Cross drainage culvert
Slope protection
30 m (100 ft) no-grub zone
Take-off ditch
Dip in road for flood protection and diversion of surface runoff

Features of a well constructed bridge crossing

FIGURE NO. 1

across streams except on permanently constructed crossings, such as bridges or culverts or on ice during the winter.

3. Right-of-way widths at stream crossings should not be greater than the minimum specified for the road class. The natural ground vegetation in the right-of-way must not be disturbed within 30 m (100 feet) of the stream.

4. Where landings are constructed, direct the drainge away from the work site into an area of undisturbed ground.

   Landings are to be a minimum of 100 m (328 feet) from any stream.

c) Grubbing

1. Place all debris in pushoff sites and crush down.

2. Do not disturb ground vegetation (i.e. do not grub) within 30 m (100 ft) of stream crossing areas until the actual start of crossing construction, and then only under the roadbed where required for stability.

3. Establish take-off ditches approximately 30 m (100 feet) from streams at the end of the undisturbed area required in 2, above.

d) Temporary Fording of Streams

Fording of streams can be environmentally damaging by causing severe and long lasting damage to stream beds and banks. However, in order to permit the early phases of road construction (right-of-way clearing and preliminary grubbing) to proceed and to allow easy construction of permanent crossings, fords will be considered acceptable on a limited basis if constructed according to the following standards. Permanent crossings must be installed immediately thereafter, prior to the completion of the clearing and grubbing phase of construction.

1. Choose a fording site with stable stream bottom (rocks the diameter of softballs or larger) and banks that will not be seriously damaged by the equipment moving across the stream.

2. Where the stream banks or bottom may be disturbed, use rock, logs, or brush mats to stablize the temporary crossing.

3. Any material placed in the stream to improve the crossing will be clean, non-erodible, and non-toxic to aquatic life, and must not be obtained from the streambed or banks.

4. Keep equipment activity in water crossing areas to a minimum.

5. Crossings should be as near to right angles to the stream as possible and limited to one lane one machine width.

6. Equipment required to enter a body of water must be mechanically sound, having no leaking fuel tanks or hydraulic lines.

7. Any material placed to stabilize stream banks or bottom that might become an obstruction to flowing water or ice must be removed after the temporary crossing is no longer needed. The fording site must be protected from erosion by seeding or placing gravel or rock on the exposed soil.

8. Temporary fords are not to be used to haul out wood.

e) Stream Crossings

Poorly constructed stream crossings do cause damage to the stream life and water quality. Bridges and culverts also increase the cost of road construction, and can create a continuous maintenance problem. The purpose of this section of the standards is therefore to provide recommendations to:

- prevent siltation of the stream which damages fish habitat and lowers water quality for downstream users;
- permit migration of fish to spawning and rearing areas;
- provide a durable, long life, low maintenance crossing.

The following comments apply to both bridge and culvert installations:

1. The size of the bridge or culvert to be placed in a natural stream should be determined from (1) the size of the area draining to the stream above the crossing, (2) the amount of rainfall that can be expected in the area and (3) the type of soil and a number of other factors including expected land use. This information is often not available to the property owner, and other sources must be used. When selecting the size of a bridge or culvert, contact any office of the Nova Scotia Department of Lands and Forests and the Nova Scotia Department of the Environment. If you are receiving government assistance to build the road, contact your local Department of Lands and Forests office.

2. Clear cutting will cause an increase in peak storm flows. Crossings below planned, clear cut areas must be sized to handle the increased flow.

3. Bridge abutments and culverts are to be aligned with the stream. To minimize the length of a structure the road crossing must be at right angles to the stream. Do not try to turn a stream to make it enter a culvert not aligned correctly.

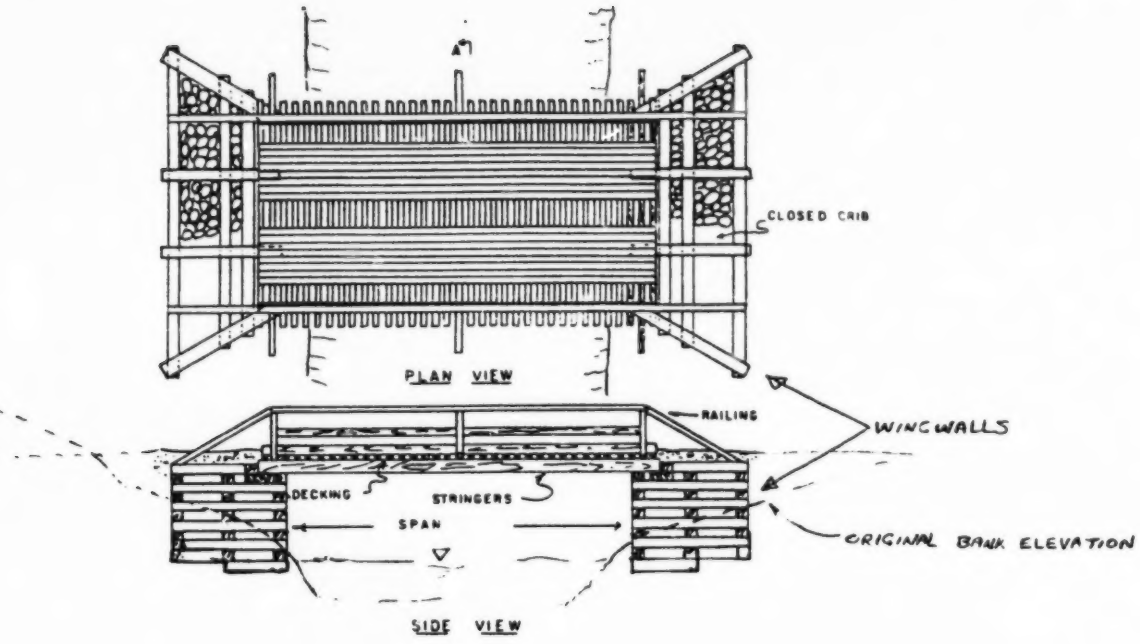
(i) Bridge Construction

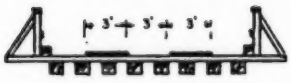
Bridges and open bottom box culverts are preferred to pipe culverts when crossing larger brooks. They maintain the natural stream width, preserve fish habitat, reduce the danger of erosion, and often reduce maintenance costs. A typical wooden bridge for which plans are available from the Department of Lands and Forests is shown in Figure No. 2. The sketch shows a permanent-type construction.

Align the road so the bridge crossings will be in an area where:

1. the road approaching the bridge site is on stable ground.

FIGURE NO. 2




SECTION "A" - "A"

TYPICAL TIMBER BRIDGE
STANDARD DESIGN

N.S. DEPT. LANDS & FORESTS

2. abutments can be located at or outside the normal streams banks.

3. the stream is narrow and has firm, stable banks.

4. construction can be carried out in the dry to minimize the necessity of machinery entering the watercourse, where possible.

Bridges should be constructed with the following features:

1. Abutments aligned with the natural stream banks.

2. The bottom of the stringers should be high enough to permit free passage of water and ice during floods.

3. Wingwalls to prevent bank erosion and slumping of the road shoulder.

Construct bridges using the following criteria:

1. Backfill material must not be removed from streambeds or banks.

2. Carry out excavation for piers, footings, and abutments in such a manner so as to pull excavated material away from stream. A backhoe is recommended for this work.

3. Where the excavation work will muddy the stream, the work must be separated from the flowing stream using non-erodible material such as, gravel, rock, straw bales, sand bags and plastic sheeting to contain silt. One third of the width of the stream channel must be left open at all times.

4. If pumping of water from the excavation is required, it should be carried out so that water from cofferdams (a cofferdam is a small dam built instream around a work area to keep it dry) is either pumped into settling ponds or across the forest floor in order that sediment (mud and silt) can settle out.

5. Remove cofferdams upon completion of construction and return the streambed to its original dimensions and stablize with rock.

6. Prevent the entry of lime, cement or fresh concrete into waterways.

7. Remove all construction debris from the stream and adjacent stream area and dispose of it by placing it where it will not be washed back into the stream by high water. Remove excess excavated material from the immediate area so that heavy rains or high stream flows will not return it to the stream.

8. The chemicals used on timbers treated with creosote or wolmanized must be completely dry before the timbers are installed below the high water mark.

(ii) Culvert Installation in Streams

1. The size of the culvert should be based on estimated storm flows as indicated in the previous section.

2. The length of culvert is important, and Figure 3 will help in calculating the proper length when the culvert is 90 degrees to the road.

3. The culvert is to be aligned with the stream. See Figure No. 4.

4. Culverts are to be placed on the natural stream gradient which must not exceed 1%. If this cannot be done due to a higher stream gradient, then an open bottomed culvert or bridge should be used. Other alternatives including baffling or the installation of natural stream bottom material in metal culverts require written approval from the N. S. Department of the Environment and cannot be installed under these standards.

5. Depending on the size of pipe, the bottom of the culvert should be set from 75 mm to 150 mm (3 inches to 6 inches) below the streambed. The bottom of a 450 mm (18 inch) pipe should be about 75 mm (3 inches) below the streambed, and a 1200 mm (48 inch) pipe about 150 mm (6 inches) below the streambed.

6. If two culverts are to be set side by side, only one needs to be set below the stream bottom.

7. Culvert pipe should be set on a firm level bottom, preferably on a bed of gravel. If the stream channel contains rocks larger than 150 mm to 200 mm (6 or 8 inches) in diameter, they should be removed, or a clean gravel bed placed over them. Large rock against a culvert pipe will damage the pipe when equipment is driven over it.

8. Fill is to be placed evenly along both sides of the pipe and packed under the bottom of the pipe. Too much fill on one side of the pipe at a time will cause it to move or bend out of shape.

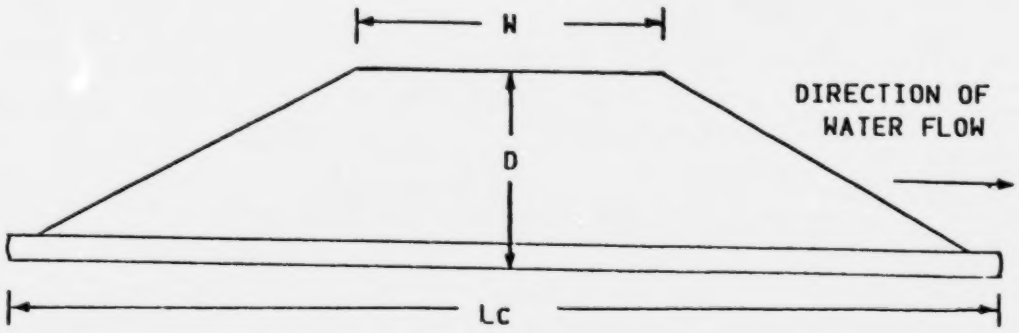
9. Be sure the fill around the culvert does not contain large rocks, stumps or sods. Rocks and stumps will damage the pipe, and sods will not give the pipe the support it requires. Culvert pipe gets much of its strength from the fill around it, therefore, it is important that the fill be of even texture and well compacted.

10. When more than one length of corrugated steel pipe is required, the pipes are to be connected with couplings provided by the manufacturer.

11. The road fill at each end of a culvert must be protected from erosion by rock or other non-erodible materials placed on the

# LENGTH OF CULVERTS

FIGURE 3




THE FORMULAE FOR DETERMINING THE LENGTH OF CULVERTS WHERE IT IS SET AT 90° TO THE ROAD ARE AS FOLLOWS:

A) FOR ROADWAYS WITH STANDARD SLOPES OF 2/1 ON BOTH THE UPSTREAM AND DOWNSTREAM SIDE:

$$Lc = W + 4D$$

B) ROADWAYS WITH STANDARD SLOPES OF 1.5/1.0 ON BOTH THE UPSTREAM AND DOWNSTREAM SIDE:

$$Lc = W + 3D$$

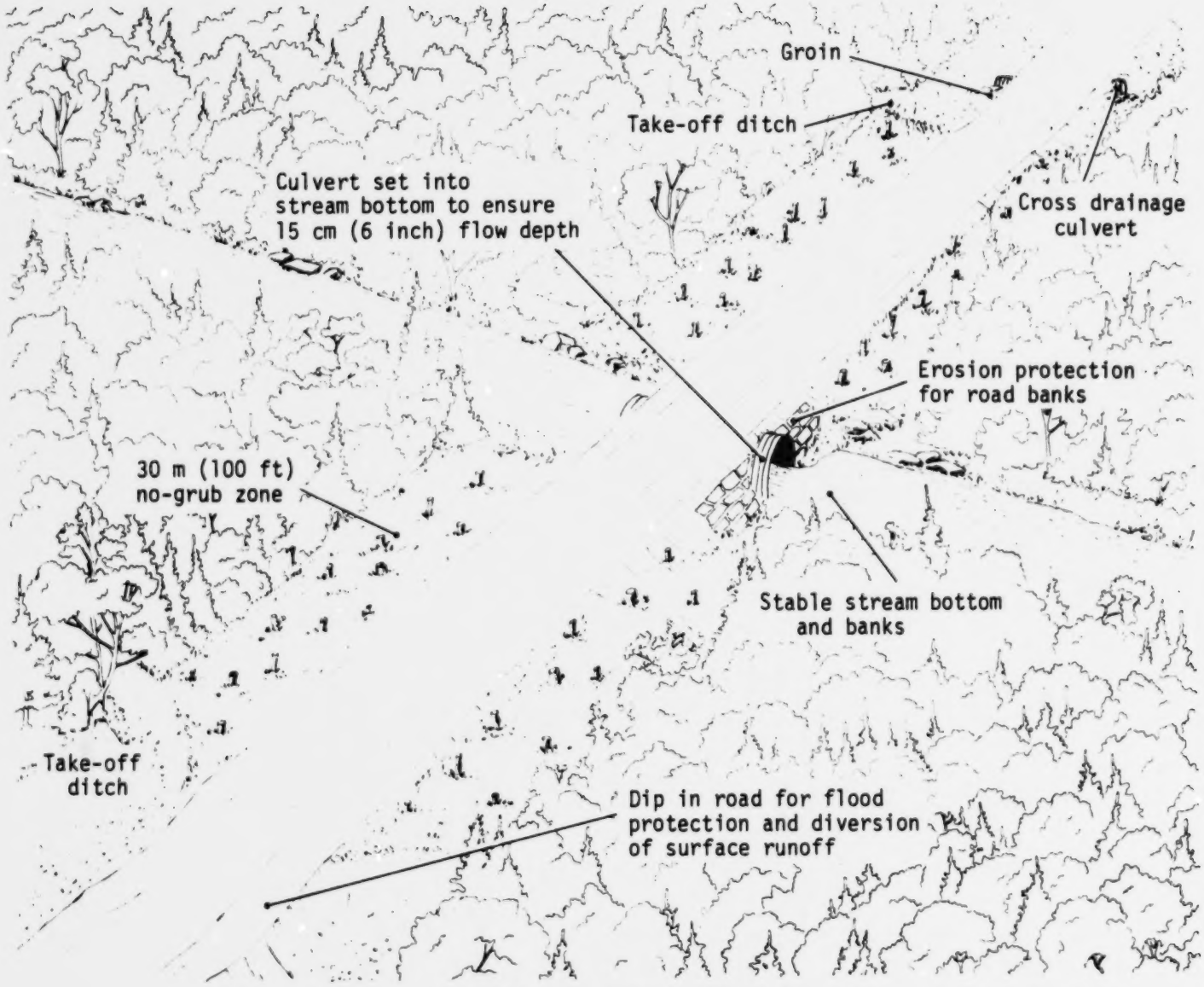
WHERE

Lc = LENGTH OF CULVERT, FT.
W = WIDTH OF ROADWAY, FT.
D = DEPTH OF FILL, FT.

EXMPLE - ROADWAY 28FT. WIDE, 4FT. OF FILL, BOTH SLOPES AT 2/1. USE (A)

$$Lc = W + 4D$$
$$= 28 + (4)(4)$$
$$Lc = 44 \text{ FT.}$$

USE A CULVERT 44 FEET LONG.




Features of a well constructed culvert crossing FIGURE NO. 4

road bank up to the top of the culvert. Be sure that such materials are on a good footing or they will collapse.

12. The stream bottom and banks at the outlet of the pipe must be protected from scour by the water leaving the pipe. If rock is not naturally present, then it should be placed on the stream banks and the stream bottom for a short distance downstream (below) of the culvert. The rock should be about 6 inches in diameter and be placed at the downstream end of the culvert for the distances indicated in the following table.

TABLE 1
Culvert Size-Length of Rock Protection

| Culvert Size | Length of Rock Protection |
|---|---|
| 450 mm (18 inch) dia. | 2.1 m ( 7 feet) |
| 600 mm (24 inch) dia. | 2.7 m ( 9 feet) |
| 760 mm (30 inch) dia. | 3.3 m (11 feet) |
| 900 mm (36 inch) dia. | 4.0 m (13 feet) |
| 1200 mm (48 inch) dia. | 5.5 m (18 feet) |

13. All excavated material and construction debris shall be disposed of away from the stream so that rain or high flow conditions will not return it to the stream.

14. Whenever possible, culverts shall be installed during periods of low flow. At all time work operations shall be conducted with a minimum of disturbance and siltation to the stream.

15. The stream should not be disturbed outside the area which will be covered by the culvert or rock apron.

f) Road Drainage

1. Properly constructed ditches including water diversions, such as cross drainage culverts and check dams, shall be used along roads where water will drain along the right-of-way, except within 30 m (100 ft.) of a watercourse.

2. Ditches shall not discharge directly into watercourses. Take off ditches can be used to divert the ditch flow off into the woods above the no grub zone.

3. Ensure that sufficient take off ditches are provided to prevent water running long distances in the road ditch.

4. Provide settling ponds of suitable size to retain runoff long enough to allow sediment to settle . A general guideline is 190 $m^3$/ha (1/16 acre-foot) of storage to be provided for every acre of exposed construction area. Settling ponds are only required near streams where take off ditches will not prevent siltation of the stream.

5. Spacing of cross culverts and take off ditches on continuous grades shall be determined as follows:

   - maximum spacing: 300 m (1,000 ft);

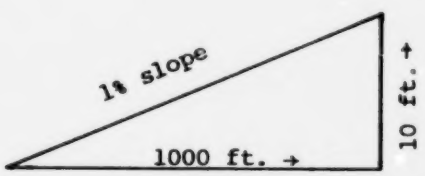
   - where the road grade is greater than 2% and where there is pick-up of runoff from sidehill drainage (flat terrain):
     600 m / % road grade (2,000 ft / % road grade);
     OR

   - where the road grade is greater than 2% and where there is runoff from sidehill drainage (hilly terrain);
     300 m / % road grade (1,000 ft / % road grade);

   (Percentages are expressed in these calculations as whole numbers (eg. 1,2,3,4, etc.) not fractions.

TABLE 2
Spacing of Cross Culverts and Take Off Ditches
on Continuous Grades

| | No Sidehill Runoff | | With Sidehill Runoff | |
|---|---|---|---|---|
| Slope | Feet | Meters | Feet | Meters |
| 1 | 1000 | 300 | 1000 | 300 |
| 2 | 1000 | 300 | 500 | 150 |
| 3 | 650 | 200 | 330 | 100 |
| 4 | 500 | 150 | 245 | 75 |
| 5 | 400 | 120 | 195 | 60 |
| 6 | 330 | 100 | 165 | 50 |
| 7 | 280 | 86 | 140 | 43 |
| 8 | 245 | 75 | 125 | 38 |
| 9 | 220 | 67 | 111 | 34 |
| 10 | 195 | 60 | 98 | 30 |




It must be noted that actual spacing is dependent on soils, sidehill slopes, road grade and a number of other factors. For this reason, the above calculations should serve as rough guides. However, if there is any doubt as to the necessary spacing of water diversions, contact the N. S. Department of the Environment or the Department of Lands and Forests.

6. Ditches should be constructed at the time of subgrade construction and with the following minimum requirements:

TABLE 3
Ditch Sizes

| | Stable Soils | Erodible Soils |
|---|---|---|
| A, B and C roads: (Nova Scotia Lands and Forests Classification) | | |
| shoulder slopes | 2:1 | 3:1 |
| back slopes | 1.5:1 | 3:1 |
| depth | 600-900 mm (2-3 ft) | 600-900 mm (2-3 ft) |
| D roads: | | |
| all slopes | 1.5:1 | 1.5:1 |
| width | 1200 mm (4 ft) | 1200 mm (4 ft) |

7. Crown the roads (150 mm (6 inch (2-3%))) to allow water to drain from the road surface.

8. Place cross drainage culverts on a 1-2% slope to prevent sediment buildup that will reduce water flow in the culvert.

9. On roads located on sidehills place culverts to drain water under the road to the downhill side.

10. Place the culvert bottom at the same level as the ditch bottom to prevent back up or damming of water.

11. Place culverts to maintain drainage in areas where deep fills are required.

12. In steep road ditches, angle the culvert across the road so that the water will flow through readily, and does not have to make a 90° turn at the inlet to flow through the culvert.

13. On long slopes, vary road grades and provide extra crowning to reduce road erosion.

g) Haul Roads

Haul roads and skid trails should be planned so that timber may be removed with minimum traffic, ground disturbance and erosion:

1. Locate the roads along contours as much as possible.

2. Streambeds, wet or dry, cannot be used as roadways, and fords will not be permitted except on a temporary basis as outlined on page 6.

3. Soils easily cut by heavy equipment should be worked when frozen or in a dry condition.

4. Where mineral soil has been exposed:

- cross ditch road running up slopes, when work is completed. Space these water diversions approximately: 300 m (1,000 ft)/ % slope
- where possible, haul roads will be seeded with grass or hay after their use is no longer required.

ROAD MAINTENANCE

1. Inspect drainage structures and ditches in the spring and fall or more frequently if required and clean or repair as required for proper operation.

2. Grade roads seasonally to fill in wheel ruts and to shape up the road.

3. Keep roads free of shading so that they will have maximum exposure to sunlight and wind.

4. Keep traffic to a minimum during excessively wet weather and when the road surface is soft.

5. Stabilize cuts, fills and ditches which show signs of erosion as soon as possible by grassing, sloping, terracing or other similar methods.

6. Remove snow drift piles and ridges left by snow plowing along the roadside before breakup to permit lateral drainage and to prevent concentration of water on road surface.

7. Store all deicing and dust control agents in areas where they cannot enter water bodies.

8. Use mechanical rather than chemical methods of brush control within 30 m (100 ft) of all water bodies and remove cut brush from the ditches.

9. Clean areas designated for sediment trapping as required and deposit material so that it cannot enter any watercourse.

FIRE PONDS

Information on how to construct a pond can be found in a publication prepared by the Atlantic Agricultural Engineering Committee, called "Farm Ponds". It was available through the Nova Scotia Department of Agriculture, but it is in very short supply. If not available at the Department of Agriculture, please contact the Department of the Environment for a photocopy.

a) Picking a Pond Site

When looking for a pond site consider these points:

1. The pond should be easily reached by road.

2. The soil should contain at least 25% clay for the pond to hold water collected from surface runoff. Gravel or sandy soils will not hold water in a pond, but may be a good source of groundwater.

3. If the pond is going to collect surface runoff there must be enough drainage area leading to the pond to fill it with water and keep it full during the summer.

4. For the woodlot to be protected more than one pond may be needed.

5. Determine the work necessary to develop the pond. The less work required the less the pond will cost.

b) Water for a Pond

Water for a pond can come from three sources; groundwater, surface runoff and streams.

1. Groundwater

When the groundwater is near the surface a pond can be constucted by digging below the water table. Since the water table moves up and down during the year, care must be taken to ensure that the pond will not go dry during the summer. Groundwater levels in Nova Scotia are usually at their lowest from late July to early October and this is perhaps the best period to construct a groundwater pond.

2. Surface Runoff

A pond can be constructed to collect surface runoff from a small area, usually 20 to 50 acres. Since there will only be flow into the pond during the spring and after a rain, the pond bottom and sides must be water tight. An outlet (spillway) must also be made to let water out of the pond during heavy rains or snow melt periods. The spillway will prevent damage to the walls of the pond by preventing overfilling and overflowing.

3. Bypass and Instream

All proposals for the construction of ponds in streams or using streamflow undergo inter-government consultation and project review before permits are issued to allow their construction. A Watercourse Alteration application must be obtained from the N.S. Dept. of the Environment for this type of work and approval must be received by the proponent from both Nova Scotia Department of the Environment and Department of Fisheries and Oceans. Please allow at least six weeks for receiving approval.

c) Environmental Requirements

1. If the pond is to be constructed so as to use groundwater, no further approval is required from the Department of the Environment. Care should be taken, however, to ensure that the pond does not become polluted from herbicides, insecticides or farm waste. Pollutants entering a pond can move downslope and pollute wells some distance from the pond.

2. A pond constructed to collect surface runoff does not require further approval from the Department of the Environment. This type of pond, however, will require a spillway outlet to permit water to flow out of the pond when it is full. The size of the spillway will depend on the size of the area draining to the pond. Assistance can be provided in selecting the size and type of spillway for your pond.

3. Instream or bypass ponds require Water Rights authorization from the Nova Scotia Department of the Environment. These types of ponds can be very damaging to the watercourse. As a result special design consideration must be given to such things as spillways, fish passage, silt control, intake screens and effects on downstream usage.

d) Safety

Safety must be considered when building a pond. Although woodland fire ponds are usually well away from populated areas, people using wood roads can come upon them. In winter a snow covered pond can look like a level section of ground, and become a trap for an unwary snowmobiler.

e) Some Tips on Safety

1. Become familiar with the responsibilities of a landowner to protect people on his property.

2. Remove all trees, stumps, brush, wire, rubbish and junk that may be hazardous to any people or animals that may be attracted to the pond.

3. Construct the pond so that there are no sudden drop-offs.

SUGGESTED READING AND INFORMATION

Handbook of Steel Drainage and Highway Construction Products 2nd Edition (1971) Fourth Printing 1977 Published by American Iron and Steel Institute, 1000 16th St.N.W.; Washington D.C. 20036 - copies may be obtained from General Manager/Chief Engineer Corrugated Steel Pipe Institute Suite 207, Crestview Plaza, Missassaugh, Ont. L5G 3P9 (approx. $4.00 subject to change).

A Guide to Trout and Salmon Habitat For Loggers - Fish Habitat Protection, Canada Department of Fisheries and Oceans, Box 550, Halifax, Nova Scotia B3J 2S7 - free upon request to the Department Fisheries and Oceans.

Forest Access Roads Planning and Construction Manual prepared by Steve D. Talbot, P.Eng. (1982) Nova Scotia Department of Lands and Forests.

Halifax, Nova Scotia
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